3. Impact of the Water Bank on Agricultural Businesses and the County Economy

The findings in Section 2 suggest that the 1991 Drought Water Bank caused purchases of farm inputs to be 2 percent lower and crop sales to be 3 percent lower than they would have been had there been no Bank in the 11 counties with no-irrigation and groundwater-exchange contracts. This implies less business for input suppliers and the handlers and processors of farm outputs in these counties. In this section, we directly investigate the Bank's impacts on the revenues, profits, and labor payments of the businesses that supply inputs and process farm products. Instead of examining the impact on input suppliers and output handlers and processors from the perspective of the farm, we examine it from the point of view of the impacted firms themselves. We will then evaluate the consistency of the two sets of findings. We will also put the changes in perspective by comparing them with historic variation in the farm economy.

While it is likely that the Bank negatively impacted certain farm-related businesses, its impact on the overall county economy is less certain. As discussed in Section 1, the Bank injected a sizable amount of money into the selling regions, which would tend to increase the demand for a wide range of goods and services. Thus, it may be that the Bank had little or no negative impact on the counties overall. Since our primary focus is on the negative impacts of the Bank, in this section we investigate whether there is any relation between the size of the negative impacts on input suppliers and output processors in a county and measures of the overall change in the county economy between 1990 and 1991.

Impacts on Agricultural Businesses

To investigate the impact of the Bank on agricultural business, we conducted a combination mail and telephone survey. We will now describe the survey and our analysis of the data.

Survey Methodology and Response Rates

As part of the farmer survey discussed in Section 2, we asked farmers to name the businesses from which they bought inputs and to which they sold their output. We developed a survey to collect data from these businesses on gross revenue, net revenue (profit), labor costs, and other indicators of firm activity in 1990 and 1991. To identify where the firms did their business, we asked about the distribution of their sales and purchases by county. We also asked about their perceptions on what factors caused gross revenues to change between 1990 and 1991.

The survey ran from July through October 1992. For each business in the sample, we first called the firm to determine the appropriate contact person and then asked that person if he or she would consider participating. We then mailed a survey form along with a description of the study and a statement of our intention to keep the names of the participants and survey information confidential. We gave firms the option of returning the survey by mail or completing it over the phone. We followed up any missing information by telephone.

The 99 farmers completing the farmer survey named 256 businesses, and we attempted to survey all of them. Farmers usually gave us the name of the business and the city in which it was located but sometimes only gave the name and general location. We were unable to find phone numbers for 101 of the firms named. This was probably due to incorrect spelling of firm name or incorrect information on location. We did find some phone numbers after some investigation and thorough scanning of phone books, but the cost of tracking down the information was prohibitive, and we abandoned this effort early on. Of the remaining 155 firms, we were unable to contact the appropriate person at 17, and 6 firms were used to test the survey instrument. Sixty-five (49 percent) of the 132 firms we were able to contact completed the survey. As shown in Table 3.1, the firms completing the survey are spread throughout the counties that sold water to the Bank. The largest share of firms is in San Joaquin County (38 percent).

The most common reason that firms refused to participate was lack of time. The survey was conducted mainly in the summer, which is their busiest part of the year. Other firms refused to participate because they were concerned about confidentiality, even though we pledged to keep the names of the participants confidential. Some firms also did not want to talk to people from Los Angeles about water, and others were so frustrated by the Water Bank and DWR that they refused to participate.

Table 3.1

Location of Agricultural Firms Completing Survey

County	Number	Percent
Butte	4	6
Colusa	3	5
Contra Costa	1	2
Glenn	0	0
Sacramento	8	12
San Joaquin	25	38
Shasta	2	3
Solano	5	8
Stanislaus	1	2
Sutter	2	3
Yolo	9	14
Yuba	0	0
Other	5	8
Total	65	100

Changes in Gross Revenues

The first line of Table 3.2 reports that gross revenues fell by 11 percent on average between 1990 and 1991 for the 62 firms in the sample that reported this information. The remainder of the table reports the percentage change in gross revenues by firm size, type of business, and location of 1990 sales or purchases. (Information on the level of revenues in 1990 and 1991 is included in Appendix B.)

Firm Size. We use 1990 annual gross revenue to classify firms by size. Gross revenue is the sum of firm sales and other sources of income. We use 1990 revenue rather than 1991 because 1990 revenue was not impacted by the Bank. Based on the distribution of gross revenue in the sample, we classify firms into three categories: those with gross revenue less than $1 million, those with gross revenue greater than or equal to $1 million but less than $10 million, and those with gross revenues $10 million or greater. Firms of all different sizes are well-represented in the sample.

Type of Business. We first categorize firms according to whether they provide farm inputs or handle farm outputs. Sixty-eight percent of the firms in our sample provide farm inputs. We have enough observations in our sample to break these firms into four categories: aerial applicators of pesticides and fertilizers; firms that sell fuel, oil, and lubricants; firms that sell, rent, or repair farm equipment (both irrigation and nonirrigation); and all other input suppliers.

Table 3.2

Average Percentage Change in Gross Revenue Between 1990 and 1991 by Firm Characteristic

	Number of Firms	Average Percent Change
All firms	62	–11
1990 gross revenues ($million)		–14
Less than 1	15	–14
1 to 10	26	–11
Greater than 10	21	–9
Type of business		
Provides farm inputs		
Applicators	8	–12
Fuel	7	–5
Equipment	11	–13
Seed, chemicals, other	16	–15
Handles farm output	20	–9
Percent of 1990 sales/purchases in 6 counties most impacted[a]		
35 percent or less	16	–9
36 to 74 percent	14	–11
75 percent or greater	26	–11

[a]Butte, Contra Costa, Sacramento, San Joaquin, Yolo, and Yuba.

The firms in this last category predominantly supply seed, pesticides, and fertilizers, although there are a few labor contractors.

The remaining 32 percent of the firms in our sample handle farm output. These firms include processors, such as canneries and refineries; haulers; wholesalers; and those that store harvested crops. Most of the firms that fall into this category perform several of these functions, so we do not break them out into separate categories.

Location of 1990 Sales and Purchases. We attempted to separate the impact of the Bank from other factors by categorizing firms according to where they do business.[1] As shown in Section 2, farming operations in some counties were affected more by the Bank than in others. One would thus expect that firms that usually do a high percentage of their business in counties the most impacted by

[1]Project resources did not allow us to survey a control group of firms. It may have been difficult to find a good control in any case. One possible control would have been firms in the counties impacted by the Bank not named by the farmers in our sample. They may have been used by other farmers in the Bank, however. Another possibility would have been to select firms in counties distant from those affected by the Bank. However, these firms may have been affected differently by confounding factors such as the Christmas 1990 freeze.

the Bank would show greater percentage declines in gross revenues than other firms; therefore, we grouped firms according to the share of purchases or sales in the counties most impacted by the Bank. We defined the counties most impacted by the Bank as those where farm operating costs as estimated in Section 2 dropped by 3 percent or more or farm crop sales dropped 4 percent or more. These counties are Butte, Contra Costa, Sacramento, San Joaquin, Yolo, and Yuba (see Tables 2.19 and 2.20). Firms are grouped into three categories: those with less than 35 percent of their sales or purchases in the six counties most impacted, those with 35 to 74 percent, and those with 75 percent of more.

Impacts Due to the Bank

According to Table 3.2, gross revenues fell 11 percent for firms that did more that 75 percent of their business in the six counties most impacted versus 9 percent for firms that did less than 35 percent of their business in the same six counties. This suggests that the Bank did have an impact on the gross revenues of firms that supply inputs and process farm outputs, but this difference does not control for confounding factors, such as firm size, type of business, the deepening recession, the Christmas 1990 freeze, and drought-induced water shortages. Below, we use regression analysis to control for the effects of firm size and type of business. Whether the resulting relation between where a firm did its business and its change in gross revenues is truly due to the Bank depends on the absence of any systematic relationship between the remaining factors and Bank inputs by county.

The statistical estimation of the regression is reported in Appendix B, and the results are reported in Table 3.3.[2] From the regression, we calculated how changing one firm characteristic, such as firm size, changes the predicted percentage change in gross revenues when the other factors in the regression are held constant. Comparisons are made to a firm with a reference set of characteristics. As a reference, we chose a firm with 1990 gross revenue less than $1 million, an equipment supplier, and a firm that sells or purchases less than 35 percent of its goods and services in the six counties most impacted by the Bank.

None of the predicted percentage changes reported in Table 3.3 are statistically different from the reference level (–12 percent). We thus do not think that the data support any strong statements about whether the Bank impacts varied by

[2]This regression is based on 56 observations, since six of the 62 firms that reported changes in gross revenue did not report where they did their business.

Table 3.3

Regression Analysis of Percentage Change in Gross Revenues

	Predicted Percentage Change[b]
Firm size ($million)	
Less than 1[a]	–12
1 to 10	–10
Greater than 10	–11
Type of business	
Input suppliers	
Applicator	–11
Fuel	–5
Equipment[a]	–12
Seed, chemicals	–13
Handles farm output	–9
Percent of 1990 sales/purchases in 6 counties most impacted[c]	
Less than 35 percent[a]	–12
36 to 74 percent	–13
75 percent or greater	–14

[a]Reference category.

[b]None of differences are significantly different from zero at 90-percent confidence.

[c]Butte, Contra Costa, Sacramento, San Joaquin, Yolo, and Yuba.

firm size or type of business. While not statistically different, the percentage decline in gross revenues rose with the percentage of business in the six counties most impacted—gross revenues fell 2 percentage points more for firms that did more than 75 percent of their business in the six counties most impacted than for firms that did less than 35 percent. This difference is consistent with the findings in Section 2. To illustrate, Table 3.4 reports the percentage change in operating costs and crop income estimated in Section 2, first, in the six counties most impacted, and second, in the remaining counties. The difference is 2.7 percentage points for both operating costs and crop sales.[3]

[3]There are some problems with comparing these two sets of differences. The difference in Table 3.4 would be expected in comparing a firm that does all its business in one of the most-impacted counties with one that does all its business in the other counties. The difference in Table 3.3, on the other hand, is between a firm that does over 75 percent of its business in the most-impacted counties and one that does less than 35 percent in the most-impacted counties. While some firms in our sample made 100 percent of their purchases or sales in the high-impact counties or 100 percent in the other counties, many did some business in both groups, as well as in counties that were not directly involved with the Bank. The former factor would cause the statistically estimated difference in Table 3.3 to understate the difference between a firm that did all its business in the most-impacted counties and another that did all its business in the other counties. On the other hand, the later would cause it to overstate the true difference. This is because firms that do business in counties

Table 3.4

Percentage Change in County Operating Costs and Crop Sales Due to Bank by County Group

Group	Percentage Change in Farm Operating Costs[a]	Percentage Change in Crop Sales[a]
Six counties most directly impacted[b]	–3.7	–4.3
Other counties directly impacted[c]	–1.0	–1.6
Difference	2.7	2.7

[a]Counties weighted by their 1991 estimated farm operating costs or crop sales.
[b]Butte, Contra Costa, Sacramento, San Joaquin, Yolo, and Yuba.
[c]All counties except Butte, Contra Costa, Sacramento, San Joaquin, Yolo, and Yuba.

Given the consistency of the results from the business and farmer surveys, we think it likely that the impact of the Bank on agricultural businesses is of the same order of magnitude as the impact on farm inputs purchases and crop sales. That is, we think it likely that the Bank caused gross revenues to fall 3 to 5 percent for business done in the six counties most impacted, 1 to 2 percent for business done in other counties directly affected by the Bank, and 2 to 3 percent overall for business in the counties where DWR bought water.

These percentage declines are somewhat smaller than those reported by the UC study on Solano and Yolo counties. The UC study found that agriculturally related income fell 3.5 percent in Solano county and 5.0 percent in Yolo county because of the Bank.[4] We estimate that the average drop is 2.0 percent in Solano, which is not one of the six counties most impacted, and 4.5 percent in Yolo, which is one of the six counties most impacted.

The UC study results are based on models of farmer behavior and their impacts on the agricultural sector. Considering that two different methodologies were used, these results are quite close. The UC results may be higher because their models do not take into account partial cultivation costs and yields on some of the land that was put in the Bank.

not directly affected by the Bank are not firms that do a high percentage of their business in the most-impacted counties. Since business was presumably better outside the counties directly affected by the Bank, the reference category is less negative than it would be if only businesses in the counties directly affected by the Bank were considered.

[4]Excludes farmer income. Coppock and Kreith (1993), p. 34.

Changes in Other Measures of Firm Activity

Changes in other measures of firm activity between 1990 and 1991 are reported in Table 3.5. On average, net revenue, or profit, fell 15 percent for the 56 firms that were able to report this information.[5] This is somewhat larger than the 11-percent drop reported in gross revenue. Labor payments, on the other hand, fell 7 percent on average. This suggests that firms absorbed more of the loss in gross revenue through lower profits than reduced labor costs.[6]

Negative Impacts of the Bank in Perspective

How do the declines in operating costs and crop sales compare with the historic variation in the agricultural economy of these counties? Based on the results from the farmer and business analyses, it seems reasonable to estimate that the Bank caused personal income from agriculture[7] (excluding Bank payments) to fall 2 to 3 percent from what it would have been in 1991 had there been no Bank. Table 3.6 reports the mean, minimum, and maximum annual percentage change in personal income from agriculture in the 11 counties impacted by the Bank

Table 3.5

Changes in Financial Statistics Between 1990 and 1991 for Firms That Supply Farm Inputs or Handle Farm Outputs

	Number of Firms[a]	Average Percent Change
Gross revenue	62	–11
Net revenues (profit)	56	–15
Labor payments	57	–7
Full-time	54	–7
Part-time	45	–6
Inventories	40	–4

[a]The number of firms that answered individual survey questions varied.

[5]Firms were asked to include the costs of rents, loan repayments, and depreciation in their calculation of profit.

[6]A firm may be reluctant to lay off its work force if it expects business to rebound in the not-too-distant future. This may be the case particularly if its workers have developed firm-specific human capital that would take time and money to replace.

[7]Personal income from agriculture is defined here as the sum of earnings on the farm, in the agricultural services sector, and in the food and kindred products sectors. These are categories used by the U.S. Bureau of Economic Analysis to report personal income.

Table 3.6

Annual Percentage Change in Personal Income from Agriculture and Agricultural Employment for Counties with NIL and GWEL Contracts

	Personal Income from Agriculture (1980–1990)	Agricultural Employment (1983–1990)
Average	–2	–1
Minimum	–22	–10
Maximum	11	8
Average absolute change	9	6

between 1980 and 1990.[8] The average absolute annual change is also reported over this period. The second column of Table 3.6 reports the same statistics for the annual percentage change in agricultural employment in the 11 counties between 1983 and 1990.[9] The drop in personal income from agriculture caused by the negative impacts of the Bank was not nearly as large as the largest annual decline in either personal income from agriculture or agricultural employment over these periods.

It is important to remember that the Bank effect is an incremental effect—it is the difference from what would have happened if there had been no Bank. Both personal income from agriculture and agricultural employment fell 4.5 percent between 1990 and 1991. These percentage drops may have been a few percentage points less had there been no Bank, but the Bank did not cause the declines to be greater than they had been between years in the 1980s. This finding suggests that the Bank did not cause declines that would threaten the structure of the agricultural economy. However, the incremental impact of the Bank could have caused structural damage to the economy if the decline between 1990 and 1991 due to other factors had been much larger.

Impact of the Bank on the Overall Economy of Selling Counties

We will now investigate whether we can detect any negative impact of the Bank on the overall economies of the counties where water was sold to the Bank. There may well be no negative impacts overall if the negative impacts on certain

[8]Figures taken from U.S. Bureau of Economic Analysis, 1992. Personal income was converted to constant dollars using the GDP deflator.

[9]Data were provided by the California Employment Development Department. Data were available for all counties back to 1983 only.

farm-related businesses are partially or completely offset by Bank payments. Even if Bank payments had no positive impact on these counties, we would expect the impact on the overall county economy to be small: The Bank caused agricultural business activity to fall 2 or 3 percent, but agriculture is only part of the county economy.

Impacts of the Bank in Relation to Overall County Economy

Table 3.7 provides a first approximation of the negative impacts of the Bank relative to the entire county economy.[10] The first column reports 1990 personal income by county. The second column estimates the overall percentage drop in county personal income caused by the negative impacts of the Bank. As detailed in Appendix B, we derive this estimate by first assuming that the personal income in the farm sector fell by the same percentage as the average of the estimated declines in farm operating costs and crop revenues. We then multiply this decline by the proportion of county income generated by farms, input suppliers, and output processors.

Table 3.7

Approximate Magnitude of Impacts of the Bank on the Overall County Economy

County	1990 Personal Income ($millions)	Estimated Negative Impact of Bank on Personal Income (percent)	Bank Payments as a Percentage of Personal Income
Butte	2,759	–0.4	0.5
Colusa	278	–0.7	2.1
Contra Costa	20,647	–0.1	<0.1
Glenn	390	<–0.1	0.1
Sacramento	19,874	–0.1	<0.1
San Joaquin	7,484	–0.4	0.2
Shasta	2,409	<–0.1	0.1
Solano	5,935	–0.1	0.1
Stanislaus	5,699	0	0
Sutter	1,032	–0.2	0.4
Tehama	612	0	0
Yolo	2,801	–0.5	0.6
Yuba	726	–0.3	3.8

[10]Stanislaus and Tehama counties are included now to act as controls. They are counties in the region (see Figure 1.1) that sold negligible amounts of water to the Bank through NIL and GWEL contracts.

Both because the estimated percentage declines in personal income in the farm sector due to the Bank are small and, in all but two cases, the percentage of county income from agriculture is less than 25 percent, the overall negative impact on county personal income is very small. The highest estimated negative impact is only –0.7 percent in Colusa County. Given the many factors that cause county income to change year to year, this will make it very difficult to identify any negative impacts of the Bank on the overall economy, even if these negative impacts were not partially or totally offset by positive impacts from payments to farmers, landlords, and water agencies.

To give an idea of the relative size of monetary inflows into the counties due to the Bank, the last column of Table 3.7 reports Bank payments as a percentage of county personal income. Payments include those made through direct groundwater contracts as well as no-irrigation, groundwater-exchange, and stored-water contracts.[11]

Relation Between Negative Impacts of the Bank and Changes in the County Economy

As shown in Figure 3.1, there appears to be no relationship between the estimated negative impact of the Bank on county personal income and the percentage change in countywide employment between 1990 and 1991. Some counties with large negative impacts show large percentage increases in employment, while some counties where we estimate the negative impacts are small show large percentage decreases.

To evaluate this apparent lack of relationship statistically, we split the counties listed in Table 3.7 into two groups depending on the estimated percentage drop in county personal income caused by the negative impacts of the Bank. The four counties with declines greater than or equal to 0.4 percent are in one group,[12] and the remaining nine counties in the other. Table 3.8 reports the average percentage change in personal income, employment, the number unemployed, and welfare payments for each group of counties between 1990 and 1991. (County-specific data are included in Appendix B). Not all of these measures

[11]Our analysis assumes that the recipients of Bank payments live in the same counties as the water they sold. We ignore, for example, the possibility that water sales in Yolo County result in payments to a landowner who lives in San Francisco. We also assume that the agricultural businesses in a county are affected in the same proportion as the drop in operating costs and crop sales in that county. In this case, we ignore the possibility that the agricultural businesses in Yolo County, say, primarily serve the farms in another county, where the impacts of the Bank on farm input purchases and crop sales were much different than in Yolo county. How far the real world deviates from these assumptions and the consequent impact of these assumptions on our results requires further analysis.

[12]Butte, Colusa, San Joaquin, and Yolo.

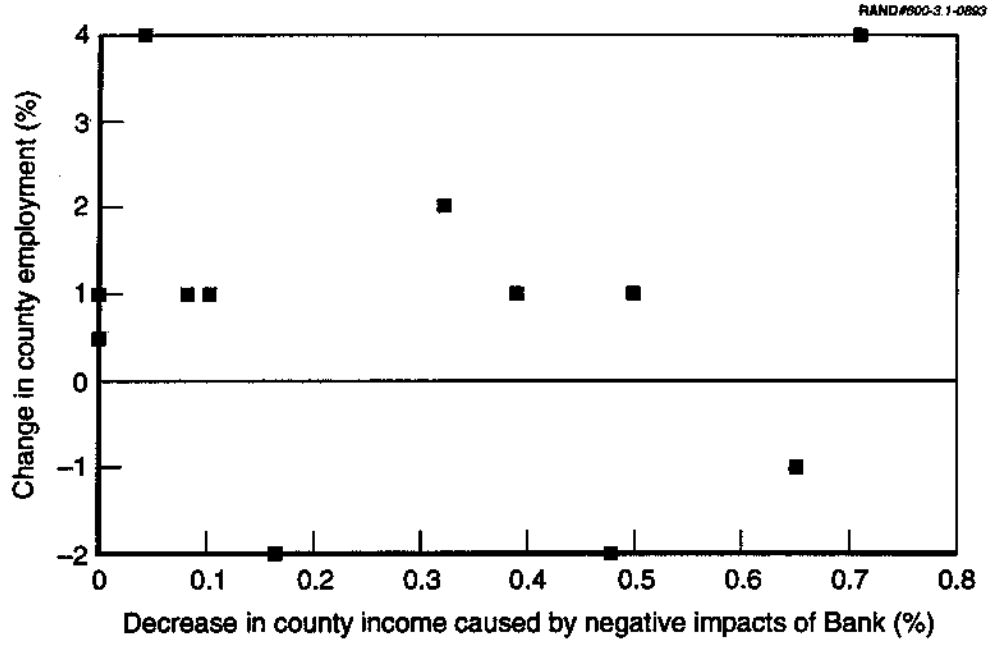

Figure 3.1—Percentage Change in County Employment Between 1990 and 1991 Versus Negative Impact of Bank on Personal Income

Table 3.8

Average Percentage Change in Countywide Economic Indicators Between 1990 and 1991 by County Group

	Estimated Negative Impact of Bank	Personal Income	Employment	Unemployment	Welfare Payments
Four counties most impacted[a]	−0.5	0.8	2.0	30.5	6.5
Other counties	−0.1	1.7	0.4	30.6	8.1

[a]Butte, Colusa, San Joaquin, and Yolo.

NOTE: Change in personal income calculated from Survey of Current Business, May 1993, p. 70. 1990 figures were converted to 1991 dollars using GDP deflator. Changes in employment and unemployment were calculated from data provided by the California Employment Development Department. The California Health and Welfare Agency provided the data used to calculate changes in welfare payments.

suggest that the four most-impacted counties fared worse than the others, and none of the differences is statistically significant.

The lack of any consistent or statistically significant differences between the counties where the negative impacts are proportionately largest and the other counties may be because, once the positive impacts of the Bank are included, there truly are no negative overall impacts of the Bank. It may also be that the

impacts are small, and we have insufficient data to sort them out from a large number of potentially confounding factors.[13]

Other Indicators of Negative Bank Impacts

Because these countywide measures may be inadequate to reveal Bank effects, we looked for other indicators as well. A downturn in the farm economy might cause the number of indigent people asking for food from local food banks to increase, so we contacted 12 food banks in these 13 counties by phone to find out how the demand for their services changed between 1990 and 1991. We found that most of the food banks had increased the number of people they served. We were unable to obtain enough quantitative information to correlate the change in people served with the approximate negative impact of the Bank, but we asked food bank representatives what had caused demand to increase. Most cited the recession as the main reason. A few mentioned immigration, drought, the freeze, local business failures, downturn in the lumber business, and inadequate pay or lack of inexpensive housing. When specifically asked about the Drought Water Bank, only a single food bank, one in Yolo county, thought that the Water Bank was a factor in the increase in demand for its services. Most food banks were unaware of the Bank and did not think it caused the number of clients to increase.[14]

Summary

In this section, we attempted to directly measure changes in the economic activity of suppliers of farm inputs and processors and handlers of farm outputs.

We investigated whether the percentage change in gross revenues between 1990 and 1991 was related to firm size and type of business but found no statistically significant differences. We also did not find a statistically significant difference in the percentage change in gross revenues between firms that did the bulk of their business in the counties most affected by the Bank and firms that did a small share of their business in these counties. However, our point estimate of the difference was consistent with the findings on estimated changes in farm operating costs and crop sales by county.

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[13]The nine "other" counties may also not be serving as good controls for the four most impacted counties.

[14]The number of people served by a food bank also depends on the food available (donated) to the banks. This supply constraint could also be a factor in the change.

Given the consistency of the findings from the two surveys, we think it likely that the impact of the Bank on agricultural businesses is of the same order of magnitude as the impact on farm input purchases and crop sales. That is, we think it likely that the Bank caused a 2 to 3 percent drop in agricultural businesses in the counties where DWR bought water using no-irrigation and groundwater-exchange contracts. The effects we predict are consistent with, although somewhat smaller than, those reported in the UC study.[15] Using different techniques, they found that agriculturally related income fell 3.5 percent in Solano County and 5.0 percent in Yolo. For these counties, we estimated drops of 2.0 and 4.5 percent, respectively.

We found that the estimated percentage drop in business of agricultural firms due to the Bank was not large compared to percentage changes in agriculturally related personal income or agricultural employment during the 1980s. It also appears that the incremental decline caused by the Bank did not cause the decline in personal income and agricultural employment between 1990 and 1991 to approach their maximum declines during the 1980s. This suggests that the Bank did not threaten the structure of the agricultural economy. However, had the fall in employment and personal income between 1990 and 1991 due to other factors been much greater, the incremental decline caused by the Bank may have been significant.

We were unable to detect any relationship between the negative impacts of the Bank that we estimate by county and the overall county economy. This may be because the Bank money injected into these counties increased the demand for a wide range of goods and services and offset the negative impacts on the agricultural sector. It may also be that the overall impacts are small and that our analysis is unable to isolate them from a large number of potentially confounding factors.

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[15]Coppock and Kreith (1993), p. 34.